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BULGARIA'S CHEMICAL INDUSTRY IN 1954

[Comment: This report represents a survey of the periodical Tezhka Promishlenost, Vol III, 1954, Issues No 1-12, for information on the expanding chemical industry in Bulgaria. Special emphasis has been placed on identification of chemical enterprises and on data concerning raw materials, production and capacities of plants, new chemical products, and related information.

Issues of Tezhka Promishlenost used as sources, as well as page numbers thereof, are indicated in parentheses.]

Development of the Chemical Industry

Before nationalization, the chemical industry in Bulgaria was organized on a small scale, without plan, and without consideration of available raw materials and the needs of the national economy. Under capitalism, the industry produced such articles as powder, toothpaste, minium, shoe polish, lacquers, paints, and linseed oil. After nationalization, it was necessary to carry out a major consolidation and reconstruction of the industry. The following chemical enterprises were reorganized: ,"Anton Yugov," "A. Vulev," "As. Zlatarov," "G. Genov," and others. The chemical industry finally developed as a branch of heavy industry after construction of the "Stalin" Chemical Combine, the Rosin Plant (Kolofonniya zavod), the factory for tanning extracts, a carbide factory in the village of Yana and another in Asenovgrad, the "Verila" chemical plant in Robertovo, the "Gorkhim" plant, factories for the production of nicotine, nicotine sulfate, and sulfuric acid, the Cellulose-Paper Plant in Krichim (gara), and others.

The chemical enterprises of heavy industry have been equipped with complex, up-to-date installations, such as installations for the production of sulfuric acid, ammonium saltpeter, and tanning extracts, and the distillation of wood, rosin extract (ekstraktsionen kolofon), turpentine, etc. The "Karl Marks" Soda Plant, representing the latest achievement of technology, has also been put into operation.

The chemical branch of Bulgarian heavy industry now produces products which until the establishment of the people's rule were imported, such as nitrogen fertilizers, nitrogen acid, aluminum sulfate, aluminum hydrate, liquid ammonia, ammonia water, aniline salt, antifouling compound (antinakip), barium carbonate, barium sulfate, tanning extracts, ethyl acetate, calcium gluconate (kaltsiev glyukonat), lacquers (acid-resistant, ship, and insulation lacquers, etc.), magnesium sulfate, medicinal glucose, nicotine sulfate, nicotinic acid, silver nitrate, calcium soda, sulfuric acid, and zinc phosphorus.

The rapid growth of the chemical branch of Bulgarian heavy industry is illustrated by the following data (1948 equals 100): 19[illegible], 167.3; and 1953, 666.1 [criterion of growth not specified].

The paper (knizhnata) industry has developed as follows (1948 equals 100): 1949, 116.6; 1950, 131.1; 1951, 146.3; 1952, 257.[illegible]; and 1953, [illegible]27.1.

By the end of the Second Five-Year Plan, the chemical industry in comparison with 1952 will increase by 90 percent, and will see the Penicillin Plant put into operation and the construction of plants for the production of vitriol, artificial fibres, and sulfate cellulose (sulfitna tseluloza). (No 3, p 6)

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In 1953, as compared with 1952, industrial production, expressed in 1939 prices, increased in various industries as follows: chemical ores, 48.9 percent; chemical industry, 35.4 percent; and cellulose and paper industry, 18.2 percent. The "Stalin" Chemical Combine fulfilled its production plan for 1953 by 127.4 percent. The salt extracting industry fulfilled its production plan for 1953 by 88.2 percent.

The plan for 1954 provided for the following production increases: salt extraction, 18 percent; cellulose and paper industry, 9.4 percent; and chemical industry, 8.5 percent. (No 1, pp 1-6)

In early 1954, the "Stalin" Chemical Combine in Dimitrovgrad and the "St. Kiradzhiev" State Cellulose Plant in Krichim (gara) pledged to increase labor productivity, increase variety of products, etc. By the end of April 1954, the entire chemical industry had made similar pledges.

Thanks to these efforts, the production plan of the "Chemical Industry" Administration for the first 9 months of 1954 was fulfilled 104.9 percent, and the labor productivity plan, 108.2 percent; costs were decreased by 5.65 percent, and a saving of 22,162,000 leva was achieved. Particularly important successes were achieved by the chemical branch [of the "Chemical Industry" Administration]. The production plan for the same period, expressed in monetary terms, was fulfilled 104.2 percent and the labor productivity plan, 108 percent; costs were decreased by 8.14 percent, and 18,053,000 leva was saved.

Instructors of the Production Department and officials of the "Labor and Wages" Department of the administration exercise systematic control of and give help to enterprises in their fulfillment of pledges. The following chemical enterprises have been given such aid: The "Stalin" State Chemical Combine, the "St. Kiradzhiev" State Cellulose Plant, the "G. Genov" State Chemical Plant, the "Dunarit" State Industrial Enterprise, the "Sodi i kislorod" (Soda and Oxygen) State Industrial Enterprise, the "Dubilni ekstrakti" (Tanning Extracts) State Industrial Enterprise, the "Kristal" State Industrial Enterprise. the "Anton Yugov" State Chemical Combine, the "Verila" State Chemical Combine, the "D. Blagoev" State Paper Factory, and the "Vasil Kolarov" State Paper Factory. During June 1954, the following enterprises were inspected and given aid: the "Gorkhim" State Industrial Enterprise, the "Stalin" State Chemical Combine in Kocherinovo, the "Elkhim" State Industrial Enterprise, the "Lakprom" State Industrial Enterprise, the "Verila" State Chemical Combine, and the "Bakelit" State Industrial Enterprise.

The "Chemical Industry" Administration issues a quarterly information bulletin in which the achievements of the leading enterprises and the shortcomings of other enterprises are discussed.

The "Stalin" Chemical Combine has succeeded in making many improvements, such as a decrease of sulfur content in slag by 1.5 percent, decrease in electric power expenditures, replacement of a conveyer system for paper bags with a telpher, introduction of precision scales, installation of an auxiliary exhaust installation for the removal of dust in the packing department, installation of troughs under the flanges of acid refrigeration equipment (to prevent corrosion), and installation of devices to counteract the sticking of saltpeter to the walls of drums.

The Rosin Plant in Velingrad has also made progress. It fulfilled its labor productivity plan for the first three quarters of 1954 by 127.1 percent. The "Anton Yugov" State Chemical Combine also fulfilled its labor productivity plan for the same period (114.3 percent), achieved a saving of 395,000 leva, and substituted lignite for 30 percent of the fuel used by its steam distributing plant.

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The "D. Blagoev" State Paper Factory in Belovo fulfilled its plan for the first three quarters of 1954 by 102.3 percent, exceeded the plan for labor productivity by 4.2 percent, and achieved a saving of 1,087,000 leva.

A number of chemical and paper enterprises, however, did not fulfill their pledges. Among these are the "Petko Napetov" State Paper Factory in Knyazhevo, the "Gorkhim" State Industrial Enterprise, the "Dubilni ekstrakti" State Industrial Enterprise, the "Vasil Levski" State Industrial Enterprise in Stalin, and the "Verila" State Chemical Combine in Ravno pole. (No 12, pp 53-57)

The "Gorkhim" and the "Petko Napetov" Paper Factory not only failed to keep their pledges but even failed to fulfill their plans.

The "Agriya" and "Dubilni ekstrakti" (Tanning Extracts) chemical enterprises fulfilled their 1954 production plans ahead of schedule. (No 12, pp 1,5)

Availability and Use of Domestic Materials

In addition to mechanizing and expanding existing mines of metallic and nonmetallic ores, mines for the following new nonmetallic ores have been established: barite, gypsum, fluorite, asbestos, feldspar, and others.

Production of nonmetallic ores (kaolin, barite, fluorite, feldspar, etc.), in comparison with 1944, has expanded as follows (1944 equals 100): 1945, 117; 1947, 187; 1949, 691; 1951, 1,799; 1953, 2,810; and 1954 (plan), 3,037. (No 8, p 3)

Kaolin is found in Bulgaria in Senovo, Kaolinovo, and other places. Bulgarian kaolin consists chiefly of kaolinite ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$) and other clay minerals. The chemical, electro-osmotic method of enriching clays, and particularly kaolins, to date has not been applied in Bulgaria. Yet almost no changes in existing kaolin enriching installations (washing kaolin with water) would be needed for reconversion to the chemical enriching process except expansion of drying installations. (No 1, p 49)

Bulgaria now produces preparations for the textile and leather industries, such as emulsifiers, industrial soaps, water softeners, wetting agents, detergents, and a number of similar special products. The factory producing these goods was established following nationalization during the process of consolidating several small enterprises. The production of such preparations before 9 September 1944 was hindered by Germany. Bulgaria was obligated to sell raw materials, primarily fats, to the Germans at low prices; these were processed in Germany and made into textile preparations which returned to Bulgaria at high prices.

It was not easy for Bulgarian chemists and specialists to begin the production of the various preparations. The capitalists had enviously guarded their production secrets by giving the most varied trade names to their products.

The first task to be solved was to begin the production of wetting agents, detergents, neutralizers (egalizatori), preparations that would foam and wash in hard water (such as is used in most Bulgarian textile centers), and other preparations. Consequently, about 11 new textile and leather preparations were developed and produced which partially satisfied the needs of Bulgarian textile and leather industries.

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The basis of the new preparations was formed by domestic raw materials, a good supply of which is available. Imported ingredients were added to local materials in the following proportions:

Preparation	Imported Ingredients (%)
"Prelamol" lubricating preparation	6
"Laurol" perillic preparation	30
"Egalit" detergent preparation	40
"Mertserol" wetting agent	100
"Inverol" wetting agent	60
"Tepanol" fulling preparation	4
"Rodoverol" perillic preparation	30
"Dermapol" emulsifier	33
"Sapunol" perillic preparation	30

After improving and introducing the preparations into the Bulgarian textile and leather industries, another task was faced: the task of producing ingredients currently imported and of fully replacing them with domestic products. Imported raw materials are primarily ketones, pyridine bases, cresols (meta and para), and higher fatty alcohols. In 1953, the Scientific Research Institute of the Ministry of Light and Food Industries developed a technological plan for the production of higher fatty alcohols from Bulgarian raw materials. Certain details remain to be studied, after which the production of such alcohols will begin in Bulgaria. In addition, there is consideration of replacing imported ketones with Bulgarian raw materials produced from turpentine.

Thus, in 1955, only cresols and pyridine bases will be imported, while the problem of higher fatty alcohols will not yet be completely solved. Under these circumstances, the above-mentioned preparations will contain the following percentages of imported ingredients:

Preparation	Imported Ingredients (%)
"Prelamol"	5
"Laurol"	--
"Egalit"	--
"Mertserol"	90
"Inverol"	55
"Tepanol"	--
"Rodoverol"	--
"Dermapol"	--
"Sapunol"	--

That which has been done to date does not completely exhaust the problems involved in producing such preparations in Bulgaria. There remains the problem of deriving preparations from naphthalene, animal glands, petroleum derivatives, and waste materials obtained in the refining process.

Simultaneously with the development of the petroleum industry in Bulgaria, it is necessary to develop the production of petrochemicals by utilizing the enormous experience of the Soviet Union, where such production exists on a large scale. Crude oil contains a number of oxygen compounds of a primarily acidic character. During the refining of crude oil with alkaline bases, these acidic compounds form soaps and are separated in an alkaline form. After purifying the soaps from the remaining hydrocarbons and water, a thick dark brown mass is obtained which is saponified petroleum. This saponified petroleum contains 40-45 percent of high molecular organic acids, the naphthenic acids. When the more volatile derivatives of crude oil are

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refined, such as gasoline, spindle and solar oils, and gas oil, purer and better quality saponified petroleum is obtained. This has a general formula $C_nH_{2n-1}COONa$ and is used as an additive in the production of soap, as an emulsifier, and as a strong disinfecting agent.

Selected naphthenic acids, obtained primarily in the refining of volatile derivatives of crude oil, when sulfonated with sulfuric acid form naphthene sulfonic acid with the formula $C_nH_{2n-1}HSO_3$. When naphthene sulfonic acid is placed under the influence of alkali, corresponding salts of a soapy nature are formed. These are most frequently influenced by a sodium base to obtain sodium salt of naphthenic acid, which is known in the USSR as the "Kontakt-Petrova" textile preparation. This preparation is being successfully used in the textile industry for the same purpose as "Igepona," "Nekalite," and "Sulfamidite," i.e., as a wetting agent, detergent, etc., in textile dyeing, as well as a medium possessing emulsifying and perillic stability.

When sulfonation of naphthenic acid is partial, e.g., when only 70 percent of the total of the sulfuric acid needed for complete sulfonation is used, or when less sulfuric acid is used than that required for complete hydrolysis of the salt, a layer of acidic salts (acidic saponified petroleum, or asidol-saponified petroleum, as it is called in the USSR) separates out. The composition of asidol-saponified petroleum is quite complex. It contains phenol and phenol-type substances. Asidol-saponified petroleum is resistant to salts of heavy metals and is used primarily for the preparation of hydrous emulsions. It is also a good emulsifier for mineral oils and paraffin, and for oiling synthetic wool. It is also used in combination with oleic acid for cleaning badly soiled fabrics.

The above-mentioned naphthenic acids, saponified petroleum, and asidol-saponified petroleum are waste materials obtained in the refining of oil and its derivatives. In addition to these, some finished petroleum derivatives, primarily those with more volatile fractions, are used in the production of chemicals. Paraffin, and paraffin, vaseline, transformer, solar, and spindle oils are used for the preparation of emulsions soluble in water for the needs of the silk, jute, flax, and wool industries. In all these emulsifying preparations, the proportion of petroleum derivatives and waste materials obtained in refining volatile petroleum derivatives amounts to 85 percent.

In addition to the production of chemicals for the needs of the textile industry, production of chemicals and oils from crude oil derivatives for the leather industry was also developed. A whole series of drum oils for lubricating leather has been produced from waste materials, obtained in refining crude oil, in combination with refined petroleum derivatives and processed plant and animal fats.

Naphthenic acid forms salts with some heavy metals which are insoluble in water. These salts, however, are soluble in organic solvents and oils and are good siccatives. Some of them are of varied colors and constitute valuable varnishes for the Bulgarian paint industry.

Petroleum derivatives with dispensed potassium soaps yield cooling and penetrating oils needed by the Bulgarian metal industry.

Thus, through the development of a variety of textile and other preparations, the Bulgarian chemical industry will be in a position to satisfy the increasingly more specific requirements of the textile, leather, and other branches of Bulgarian industry with varied, high-quality products and will base its production exclusively on domestic raw materials. (No 19, pp 33-35)

Before Bulgaria had discovered crude oil deposits, the production of a large part of the lubricants needed by the economy was based on petroleum residue, imported in recent years from the USSR. Under existing conditions, the production of lubricants could not have been placed on a modern basis, i.e., on the basis of vacuum distillation columns. For a long time, production of lubricants was based on single-still vacuum distillation units, working consecutively, process after process, despite the obvious shortcomings of such a system. Only low-quality lubricants were produced and the level of utilization of raw materials was low. Almost all lubricants needed by the national economy were imported.

The rapid development of domestic industries after 9 September 1944 also contributed to an expansion of the production of lubricants.

During the period 1948-1949, a three-tank vacuum distillation unit [article contains diagram of this installation] was constructed and put into operation. The distillation process was fractional, since it was divided into three consecutive large distillation retorts, which worked simultaneously and continuously. The first prepared the petroleum residue for distillation, the second separated volatile oil fractions from the residue, and the third separated heavy oil fractions as it completed the distillation process, leaving asphalt. The transmission of the contents of one distillation tank to the next was accelerated through the creation of a vacuum.

However, this distillation system, in spite of all its advantages, still could not produce highly viscous lubricants. This installation also revealed the basic shortcoming of still batteries: the occurrence of cracking because the distilled mass remains for a considerable time in contact with the highly heated surfaces of the distillation unit. In order to avoid this undesirable factor, working temperature is limited to 370 degrees centigrade which is entirely inadequate for separating heavy oil fractions. These decompose partially, but their main mass remains in the asphalt, undistilled. For this reason, almost all special high-quality and highly viscous lubricants cannot be produced in Bulgaria and must be imported.

With the discovery of her own oil deposits, it is expected that Bulgaria will soon introduce modern column-type installations for the domestic production of motor fuels and lubricants. (No 8, pp 36-39)

Development of Aniline Dyestuff Production

After the nationalization of industry, domestic dyestuff production began to expand. The "Koloriska" Enterprise, which had not been able to develop because of capitalist competition, was reorganized to achieve a planned and varied production of sulfur dyestuffs for the needs of the textile industry. In 1948, the former "Bulkhima" Enterprise in Kostenets (gara) was reorganized into the "Anton Yugov" Plant for the production primarily of acidic and direct azo dyestuffs, ultramarines, etc.

On the basis of research carried out by the two plants during the years of the First Five-Year Plan, production was organized of 25 kinds of azo dyestuffs, 2 kinds of chrome dyestuffs, 5 kinds of pigments and oil paints, 5 kinds of sulfur dyestuffs, and 14 kinds of intermediates for the above products. In a short period of time, the task of increasing the variety of domestic dyestuffs for the needs of the population was successfully accomplished. Domestic production of sulfur dyestuffs supplied almost the entire needs of the textile industry. As a result, the import of aniline dyestuffs was decreased by about 50 percent, and several million leva in foreign credits was saved annually.

Research carried out by the Central Scientific Research Institute for Textile Fibers has proved that dyestuffs produced in Bulgaria were identical with imported products in their chemical composition, structure, and properties. Moreover, the dyeing power, i.e., the concentration of Bulgarian dyestuffs, is 30-50 percent higher than that of imported products because the latter are excessively diluted in order to increase profits.

Bulgarian specialists, encouraged by the successes already achieved, began in 1953 to study the technology of synthetic dyestuffs and apparatus for the production of a number of high-quality indanthrene, chrome, and sulfur dyestuffs. In addition, research was carried out to improve the technology of production and the pureness of shade of dyestuffs already in production.

As a result of these studies, Bulgarian specialists, working in three scientific research groups -- namely, the laboratory of the "Chemical Industry" Administration, the "Koloriska" State Industrial Enterprise, and the "Anton Yugov" State Chemical Plant -- successfully completed in early 1954 a series of laboratory experiments for the production of 10 indanthrene, 4 chrome, one pyrazolone, and 2 sulfur dyestuffs, or a total of 17 dyestuffs and 10 intermediates.

Of this total, 5 indanthrene dyestuffs (Indanthrene Dark Blue BOA, Indanthrene Olive T, Cibanon Green, Indanthrene Brilliant Green B, and Brilliant Green GG), one chrome ("Eriochrome" Black T), and 4 intermediates (benzathrone, violanthrone, dibromobenzathrone and 6-, 1-, 2-, and 4-nitrodiazooxide-sulfonic acids) were studied by the group headed by G. Georgiev and organized within the "Chemical Industry" Administration.

A second group, at the "Anton Yugov" State Chemical Plant, studied the technology of and produced in a laboratory 4 indanthrene dyestuffs (Algol Yellow, Indanthrene Yellow GK, Algol Pink BBK, and Indanthrene Khaki), 3 chrome dyestuffs (bordeaux, red, and violet), one pyrazolone yellow pigment ("Echtlicht" Yellow EGG), and 6 intermediates (nitroanthraquinone, dinitroanthraquinone, aminoanthraquinone, diaminoanthraquinone, phenylhydrazine, and phenylmethylpyrazolone).

At the same time, the group at the "Koloriska" State Industrial Enterprise conducted a study which included a number of laboratory and plant experiments designed to improve the quality and pureness of shade of dyestuffs then in production at the enterprise, such as sulfur green, sulfur blue which is fast to light, and Sulfur Blue K, as well as to increase the assortment of production by introducing a sulfur brown dyestuff, Sulfur Olive "09," and Indanthrene Olive G.

Dyeing operations carried out in certain Bulgarian textile plants and through testing by the Central Scientific Research Institute for Textile Fibers have shown that quality characteristics (fastness of light, washing, etc.) of these dyestuffs are in no way inferior to imported products.

In addition to studying and mastering production of the above mentioned dyestuffs and their intermediates, Bulgarian specialists during the period 1951-1953 investigated the basic technology and apparatus for the production of 16 intermediates of azo dyes and chrome dyestuffs, and a plan was prepared for the construction of a universal installation for their production. The latest achievements in this field, as published in Soviet literature, and the experience of the Polish "Boruta" Plant have been utilized in the construction of the installation.

The successes already achieved in such a short period of time prove that Bulgaria also has the capacity to produce aniline dyestuffs, and at prices lower than those of imported dyestuffs.

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Taking these achievements under consideration, the Sixth Congress of BKP has placed new important tasks before Bulgarian specialists in this field during the Second Five-Year Plan.

During 1955, the result of studies designed to improve the quality and pureness of shade of sulfur dyestuffs (blue, green, and olive) manufactured by the "Koloriska" State Industrial Enterprise must be brought into production and the manufacture of indanthrene olive and other dyestuffs which are fast to light must be initiated.

The directives of the Sixth Congress provide for increased production in the textile industry (this production in 1957 is to be at least 57 percent greater than in 1952), as well as improved quality of dyed fabrics and increased color assortment. Provisions have been made to construct a plant for artificial textile fibers, the dyeing of which, according to plan, will require hundreds of tons of dyestuffs, primarily sulfur dyestuffs. Such a sharp increase in production of textile fibers calls for an equally sharp increase in production of aniline dyestuffs, as well as introduction of new types of high-quality chrome, sulfur, indanthrene (fast to light), and other dyestuffs.

If one considers that the capacity of existing plants is insufficient and import of such dyestuffs is limited and expensive, one realizes that this import problem can best be solved by the construction of a new modern plant for aniline dyestuffs and their intermediates. The plant, which should at first have four shops -- for sulfur, chrome, and indanthrene (anthraquinone) dyestuffs, as well as for azo dyes and their intermediates -- would eventually develop into a combine for aniline dyestuffs, pharmaceutical preparations, and their intermediates. A major part of the raw materials necessary for the production of aniline dyestuffs and their intermediates is already domestically produced (sulfuric acid, hydrochloric acid, nitric acid, soda ash, caustic soda, ammonium, oleum, sodium sulfide), and the remaining raw materials -- benzene, toluene, naphtalene, and anthracene -- may be easily imported, chiefly from the People's Democracies. Following the development of the coking and oil-processing industries in Bulgaria these imported raw materials also will be locally produced

If it will not be possible to construct the plant during the Second Five-Year Plan, it will be necessary to reconstruct and complement the equipment of the two existing enterprises with a view to introducing the dyestuffs and intermediates which have been studied and increasing the production and assortment of dyestuffs currently in production.

It is also important that the planned universal installation for intermediates of azo dyes and chrome dyestuffs be constructed so that it may be used for studies designed to master the production of high-quality vat indanthrene dyestuffs, acidic anthraquinone dyestuffs, ice colors to be developed, and leather "uhrsols." The lack of such a universal installation, with which all modern foreign plants are equipped, hinders research work not only in the enterprises, but also in the recently established Scie[illegible] Research Institue for the Chemical Industry and Related Matters, which [illegible] also without a scientific experimentation base. (No 7, pp 8-[illegible])

Utilization of Chemical Waste Materials

A number of Bulgarian industrial enterprises do not utilize waste materials which are of importance to the national economy. Sulfur found in pyrites is utilized in a sufficient degree for the production of sulf[illegible]c acid; but waste materials obtained in roasting pyrites, i.e., pyrite [illegible]g,

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are not fully utilized in Bulgaria. Composition of pyrite slag varies, depending on the quality, but on the average it is as follows: sulfur, 2.5-5 percent; iron, 45-50 percent; and copper, 0.5-1.3 percent. Some types of pyrite slag also contin gold and silver in such amounts as to make their extraction profitable.

With the forthcoming increase in production of sulfuric acid, the amount of slag will also increase. Moreover, Bulgarian ferrous metallurgy is already expanding, putting increasing demands on the production of iron ores and ferrous materials. Bulgarian need for copper and copper compounds is also on the increase. Consequently, it is necesary that ways be found to utilize pyrite slag fully. It is also necessary to study waste materials obtained in roasting zinc ores.

Another type of waste material obtained in the production of sulfuric acid is a gas which escapes into the atmosphere. This gas contains up to 0.4 percent of sulfur dioxide. The amount of gas obtained per each ton of 100-percent sulfuric acid can yield 120-140 kilograms of sodium bisulfite, which is a valuable preservative for a number of products. Waste gases which contain up to 0.5 percent of sulfur dioxide may also yield crystalline sodium metabisulfite. The need for these chemicals in the canning, leather, chemical, and other industries is large, and the possibilities for producing them in Bulgaria with small capital investment are good. Therefore, it is imperative that the appropriate research institutes study this question and that Bulgaria begin such production.

Production of soda ash by the ammonia method, which has been accepted as the most modern (owing to the considerable superiority of the apparatus utilized and a high mechanization of labor), shows certain shortcomings in relations to raw materials utilization. The utilization coefficient of sodium chloride and carbon dioxide even now is low since chlorine and lime are almost entirely lost. Possibilities exist for a partial utilization of these products. For example, the residue obtained in purification of crude brine, which contains finely dispersed calcium carbonate and magnesium carbonate, may be used as a component part of thermoinsulation materials of the Sovelit type.

Diffused waste calcium carbonate obtained in the production of caustic soda from soda ash and slaked lime, well washed of alkali, is of value as a material for the production of cement. A study may also be made to obtain waste calcium carbonate with a sufficient purity to satisfy the requirements set by pharmacopoeia. There is also a possibility of using a certain amount of waste calcium chloride in construction as an admixture to water for concrete. Addition of $CaCl_2$ to concrete increases its durability. It is necessary to determine Bulgaria's needs for these waste mateials, what supplementary equipment should be constructed for their processing, and what would be the cost of this to the national economy.

Waste materials obtained in the production of synthetic [illegible] vary in amount and kind depending on the raw materials and the technology involved. Of greatest interest, under Bulgarian conditions, are coal slag, and some [illegible] gases. It is necessary to study the possibilities of a greater utilization of slag. An important type of waste material are gases, which vary in their composition. When raw industrial gas (obtained from coal in the production of synthetic ammonia) is purified, gases containing hydrogen [illegible]de are obtained. Research carried out by means of an experimental installation at the "Stalin" Chemical Combine has shown that high-quality (elemental) sulfur can be obtained from such gas. Additional research will solve the problem of industrial production of such sulfur.

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In water scrubbing of industry gas, a large amount of waste gas contains over 90 percent of carbon dioxide. At present, this type of gas is used partially in the production of carbamide, and liquid carbon dioxide is collected in steel bottles for the needs of the food industry. Taking into consideration the need to economize on those materials from which other small enterprises produce carbon dioxide, it has been necessary to consider whether the existence of such enterprises is economically justified and whether it is possible to satisfy the needs of the national economy for carbon dioxide -- liquid and solid ("dry ice") -- by fully utilizing these waste gases.

Other waste gases obtained in the production of ammonia are those which contain hydrogen or carbon monoxide.

Another source of waste materials is found in the production of calcium carbide. Theoretically, per each ton of carbide, 437.5 kilograms of carbon monoxide is obtained, which corresponds to 370 cubic meters of gas. With small furnaces such as Bulgaria possesses, this gas cannot be utilized and is dissipated. It is necessary to have furnaces of a semicovered type with a capacity up to 25,000 kilowatts, especially equipped for trapping the escape gases.

Fine powder which is obtained in crushing carbide is also improperly utilized in Bulgaria. At present, this powder is not separated from the regular product. Owing to the greater surface subjected to the influence of atmospheric moisture, a large part of acetylene contained in the powder is lost, and the quality of carbide is decreased. The correct procedure would be to extract the acetylene from the powder immediately following the process of sifting and sorting of crushed carbide. The acetylene thus obtained could be utilized in organic synthesis.

When considering the direction which the Bulgarian carbide industry should take in the future, the problem of the fullest possible utilization of these waste materials and the development of organic synthesis on the basis of acetylene (production of synthetic rubber, etc.) should be studied.

The chief waste materials in the production of sulfite cellulose are wood chips (of a size which makes them unsuitable for cellulose production), so-called silt of sulfite soap, a residue (which chiefly contains dispersed calcium carbonate), and turpentine with an admixture of a mercaptan.

Waste chips are utilized at present for fuel. This, however, is not the best solution to the problem, particularly if one considers the shortage of coniferous materials in Bulgaria

No suggestion as yet has been made to utilize waste sulfite soap. In spite of its good foaming and washing qualities, it is not sought for laundry work, even though it is low-priced, because of the unpleasant odor emitted by the mercaptan that it contains. It is necessary to find ways of utilizing this soap, either directly or after processing. Of interest is the question of improving the quality of cement clinker by adding sulfite soap to it. The question of using the soap as an initial material in the production of glues and oil and tar acids has not been studied.

The possibility of utilizing waste dispersed calcium carbonate, obtained in the regeneration of alkaline solutions, has not been explored.

Of considerable interest also is the problem of deodorizing turpentine obtained as a by-product in the production of sulfite cellulose. The Cellulose Plant has already made progress in this direction, and it may be expected that the deodorizing of tyrpentine will soon take place on an industrial scale.

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Production personnel and scientific research institutes in Bulgaria are faced with the task of a systematic organization and thorough study of the questions connected with the utilization of chemical waste materials. Their work should proceed in two directions: (a) to find ways of best utilizing waste materials; and (b) through a detailed study of technological processes and material balances, to decrease waste materials to a minimum. (No 10, pp 5-11)

"Stalin" Chemical Combine

The "Stalin" DKhK (State Chemical Combine) in Dimitrovgrad produces the following: industrial sulfuric acid, oleum, battery acid, rarefied nitric acid, ammonium hydroxide, carbamide, ammonium nitrate, sodium nitrate, ammonium sulfate, sulfur fumes, oxygen, liquid sulfur dioxide, carbon dioxide, and other chemical products. (No 6, p 64)

Work at the carbamide production shop, which occupies a three-story building at the "Stalin" Chemical Combine, is fully mechanized. Among the workers are machinists, equipment operators, laboratory technicians, repairmen, and centrifuge operators.

Carbamide is used as fertilizer, particularly of industrial crops, such as cotton, tobacco, and vegetables; it is also used in the pharmaceutical industry. In industry it is used in the production of various lacquers, paints, nylon articles, etc.

Carbamide is a synthetic product of ammonia and carbon dioxide. It is obtained at a pressure of 200 atmospheres and a temperature of 180-200 degrees. Liquid ammonia, under high pressure and temperature, fuses with carbon dioxide and is transformed into small crystals which are separated in a centrifuge in the form of a snow-white powder resembling powdered sugar. This powder is carbamide; it may be used in this form or processed further.

Carbon dioxide used in the production of carbamide formerly was released into the air; now it is collected in steel bottles and utilized in the soda and lemonade industry.

The manager of the carbamide shop is Yrdan [sic, presumably Yordan] Yordanov, and the technical manager is Dimitur Filipov. The shop is particularly proud of Yordan Stoyanov, the best innovator in the combine; due to his innovations, productivity of the compressor has increased 10 percent.

The job of Stakhanovite Veselina Shtilyanova is to look after norms and quality control in the process of fusion of ammonia with nitrogen acid.

Twice during 1953, the shop was declared to be the outstanding shop of the entire combine. All plans for 1953 were fulfilled and, in October 1953, the shop began working on the plan for 1954. Labor productivity was increased 66.6 percent above plan. During the first 9 months of 1953, the shop achieved a saving of 149,905 leva, of which 31,371 leva was saved on the use of steam. Costs were decreased 16.2 percent.

In order to improve workers' qualifications, five courses are being conducted in the shop at present. Stakhanovite methods are applied in the combine in 2 shops, one production unit, 11 shifts, 26 brigades, and one laboratory.

Workers of the combine live in "Tolbukhin" kvartal, which contains over 80 many-storied apartment houses, stores, nurseries and children's homes, a hospital, a public bath, a school, and 3 libraries. (No 1, pp 52-56)

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"Verila" Chemical Combine

In spite of the fact that the "Verila" Chemical Combine was lagging in its work during the first 2 months of 1954, the workers pledged to exceed the annual assortment plan by starting production on three new preparations for the textile and silk industries and to develop technological processes and create the means for substituting domestic production and auxiliary materials for imported materials.

The combine's leaders accomplished a number of technological improvements. Compressor mixing of the heated mass was introduced at the third distillery. This leads to an improved heat exchange and saves considerable time and fuel. Perfected vacuum and condenser systems have been installed in the distillery through the introduction of an auxiliary water pump which accelerates the production process and improves the quality of oils. A modern blower system has been installed at the blower installation of the new steam boiler for the cleansing of residue and the blowing-through of fire tubes and smoke vents. This makes it possible to utilize low-calory coal and brings additional savings.

A number of other technical and organizational improvements have been made. A special installation for the production of ice has been installed which will bring a saving of over 6,000 leva per annum. In addition, a new mixer for textile preparations has been constructed.

The combine administration and the scientific-technical society have begun working on technological improvements designed to replace imported materials with domestic materials. They have discovered that methyl hexanone and tetralin can be replaced with domestic para-menthenol for a saving of 150,000 leva per annum. They have also discovered a method of utilizing the oil residue obtained in the cleaning of reservoirs for lubricants and oils, whereas until now it had been discarded.

The plan for the first quarter of 1954 was fulfilled 103 percent, and for the second and third quarters, 110 percent. The quality of production was considerably improved. The quality of "Laurol" and oils in regard to carbon number and color has been very much improved. Production has started on a specialized sulfurized grease (osernena gres) for high temperature loads, which until now has been imported and which is so necessary for the steel lathes of the "Lenin" Metallurgical Plant. Production has also begun on the "Prelamol" and "Dermapol" preparations which are extremely valuable for the textile and leather industries and which counteract the unpleasant smell of textiles and leather.

In spite of these achievements, combine personnel are still dissatisfied with their progress and have pledged even greater effort in fulfillment of production and labor productivity plans. (No 11, pp 57-60)

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